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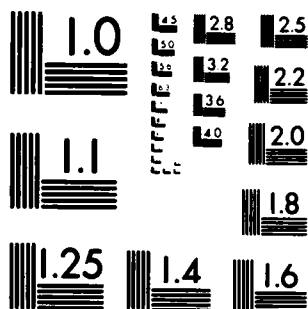
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FINAL REPORT

OFFICE OF NAVAL RESEARCH  
GRANT NUMBER N00014-84-G-0041

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U.S. Army Medical Research  
and Development Command  
Grant DAMD17-84-G-4005

Conference Grant for Second World Congress on Biomaterials

held in

Washington, D.C., U.S.A.

April 27 - May 1, 1984

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JUL 1 8 1984  
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Congress Chairman - S. F. Hulbert  
Editor and Program Chairman - J. M. Anderson  
Local Arrangements Chairman - A. C. Fraker

Submitted to:

Office of Naval Research  
Department of the Navy  
Arlington, Virginia 22217

JUNE, 1984



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The total number of papers presented was 361. There were 191 oral presentations and 170 poster presentations. You will note from Table 2 that the authors came from 18 different countries.

There were 140 papers dealing with applications of biomaterials in orthopedics, 78 papers dealing with biomaterials for cardiovascular applications, 39 papers dealing with dental applications of biomaterials, and 104 general papers. Table 3 shows a more detailed breakdown of papers by topic.

Table 4 shows the description of papers according to oral and poster sessions.

All of the technical sessions were exceptionally well attended. The poster sessions served as a major vehicle of discussion for the participants. Certainly one of the highlights of the Second World Congress on Biomaterials were the keynote addresses. Table 5 lists the keynote addresses.

The session on Technology Transfer (see Table 6) evoked a great deal of discussion. There was so much interest that it was difficult to close the session, and the meeting spilled well over into the time allotted for the annual meeting of the Society for Biomaterials.

The opening ceremonies were well attended, and the international guests appreciated being welcomed by Dr. James Wyngaarden, Director of the National Institutes of Health.

The banquet speaker was Mr. John C. Villforth, Director for the National Center for Devices and Radiological Health, FDA, who spoke on the FDA's role in biomaterials development evaluation.

The 1984 Clemson Awards were presented at the banquet. The Award for Applied Research went to Dr. Vincent Gott, The Johns Hopkins Hospital, Baltimore, Maryland; the Award for Contributions to the Literature went to Professor Allan S. Hoffman, Center for Bioengineering, University of Washington, Seattle, Washington; the Award for Basic Research went to Professor Otto Wichterle, Prague, Czechoslovakia.

## FINAL REPORT

### SECOND WORLD CONGRESS ON BIOMATERIALS

The Second World Congress on Biomaterials was held in Washington, D.C., U.S.A., on April 27 - May 1, 1984. The meeting was the 16th international biomaterials symposium and was held in conjunction with the 10th annual meeting of the Society for Biomaterials.

The meeting was sponsored by:

Biomaterials Group of the Biological Engineering Society of the  
United Kingdom  
Canadian Biomaterials Society  
European Society for Biomaterials  
Japanese Society for Biomaterials  
Society for Biomaterials, U.S.A.

It was the largest and most international meeting ever held in the field of biomaterials. Total registration was 823, with 201 international guests from 25 countries. Please see Table 1 for a historical presentation of the attendance at international biomaterials symposia.

The meeting was partially supported by:

National Institute of Dental Research  
Food and Drug Administration, National Center for Devices and  
Radiological Health  
Office of Naval Research  
U.S. Army Institute of Dental Research  
National Bureau of Standards

In addition, the following industrial concerns contributed to the support of the Second World Congress on Biomaterials:

Bard Implants, Inc.  
Biomet, Inc.  
Calcitek, Inc.  
Carbomedics, Inc.  
E.I. duPont de Nemours & Co.  
DePuy, Inc.  
Ethicon, Inc.  
Howmedica, Inc.  
Impra, Inc.  
International Hydron Corporation

The 1984 Student Awards for Outstanding Research went to Ph.D. candidate Roger E. Marchant of the Department of Macromolecular Science, Case Western Reserve University, for his paper "In Vivo Leukocyte Interactions with Biomer." The one for Intern, Resident or Clinical Fellow Category went to Dr. Harry B. Kram, Harbor-UCLA Medical Center, for his paper "Use of Fibrin Sealant in Experimental Tracheal Repair." The one for Undergraduate, Master's or Health Sciences Degree Candidate went to Michael L. Salgaller, Children's Hospital, Columbus, Ohio, for his paper "Immunogenicity of Glutaraldehyde-treated Bovine Pericardial Tissue Xenografts in Rabbits."

The Transactions of the Second World Congress on Biomaterials were distributed to the participants and to the members of the Society for Biomaterials which weren't able to attend the World Congress. The Transactions, entitled Biomaterials '84, will serve as a major reference source for many years to come. Copies of the Transactions are available for \$25 from the Office of the Society for Biomaterials.

Dr. James M. Anderson,, Departments of Pathology and Macromolecular Science, Case Western Reserve University, Cleveland, Ohio, served as Editor of the Transactions and Program Chairman of the World Congress.

Program Committee

|                          |   |
|--------------------------|---|
| J. M. Anderson, Chairman | Society for Biomaterials (U.S.A.)                                       |
| B. Ratner                | Society for Biomaterials (U.S.A.)                                       |
| S. Barenberg             | Society for Biomaterials (U.S.A.)                                       |
| R. Kennedy               | Society for Biomaterials (U.S.A.)                                       |
| C. Hassler               | Society for Biomaterials (U.S.A.)                                       |
| G. Drouin                | Canadian Society for Biomaterials                                       |
| D. C. Smith              | Canadian Society for Biomaterials                                       |
| P. J. van Mullen         | European Society for Biomaterials                                       |
| T. Yokobori              | Japanese Society for Biomaterials                                       |
| G. Hastings              | Biological Engineering Society<br>(Biomaterials Group - United Kingdom) |

The Organizing Committee for the World Congress consisted of:

|                         |   |
|-------------------------|---|
| S. F. Hulbert, Chairman | Society for Biomaterials (U.S.A.)                                       |
| H. Plenk, Jr.           | European Society for Biomaterials                                       |
| H. Kawahara             | Japanese Society for Biomaterials                                       |
| D. Smith                | Canadian Society for Biomaterials                                       |
| D. Williams             | Biological Engineering Society<br>(Biomaterials Group - United Kingdom) |

The Local Arrangements Committee consisted of:

|                           |                 |
|---------------------------|-----------------|
| A. C. Fraker, Chairperson | F. A. Pitlick   |
| S. R. Torrence            | T. N. Salthouse |
| K. C. Stang               | R. R. Stromberg |
| S. L. Gordon              | P. Sung         |
| E. Horowitz               | T. M. Valega    |

The social events served as a major vehicle for communication between biomaterials researchers. The social functions included a wine and cheese reception on Friday, April 27th; a concert at the Kennedy Center with the Boston Symphony performing, Seiji Ozawa conducting and Peter Serkin at the piano Saturday, April 28th; the Awards Banquet on Sunday, April 29th; and an Old Fashioned American Barbecue at Smokey Glen Farm in Maryland on Monday, April 30th. Numerous kind comments were received from the participants about the social events. The international participants particularly enjoyed the Kennedy Center concert and the Old Fashioned American Barbecue

Shakespeare wrote in Julius Caesar:

"There is a tide in the affairs of men  
Which, taken at the flood, leads on to fortune;  
Omitted, all the voyage of their life  
Is bound in shallows and in miseries.  
On such a full sea are we now afloat;  
And we must take the current when it serves  
Or lose our venture."

The Second World Congress on Biomaterials was the largest, most international, most interdisciplinary meeting held to date in the field of biomaterials. The Congress, hopefully, will serve as a major stimulus to biomaterials research for many years to come and, thus, eventually the development of improved biomaterials resulting in improved health care and quality and quantity of life for all the citizens of our World.



TABLE 1

## ATTENDANCE AND PAPERS PRESENTED AT INTERNATIONAL BIOMATERIALS SYMPOSIA

|                           | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980    | 1981   | 1982    | 1983 | 1984     |
|---------------------------|------|------|------|------|------|------|------|------|------|------|------|---------|--------|---------|------|----------|
| No. of Domestic Attendees | 100  | 112  | 77   | 196  | 302  | 314  | 321  | 265  | 334  | 318  | 330  | 300     | 231    | 421     | 298  | 622      |
| No. of Foreign Attendees  | ---  | ---  | 2    | 8    | 48   | 52   | 61   | 60   | 74   | 57   | 87   | 120     | 27     | 109     | 85   | 201      |
| Total Attendees           | 100  | 112  | 79   | 204  | 350  | 366  | 382  | 325  | 408  | 375  | 417  | 420     | 258    | 530     | 383  | 823      |
| Total No. of Sessions     | 4    | 3    | 4    | 11   | 12   | 9    | 6    | 21   | 22   | 23   | 27   | 41(2)   | 26(1)  | 29      | 37   | 78       |
| Total No. of Papers       | 17   | 16   | 17   | 45   | 87   | 101  | 92   | 165  | 143  | 122  | 128  | 206(90) | 131(6) | 142(32) | 130  | 361(170) |
| Dental/Oral               | 5    | 14   | 2    | 15   | 24   | 21   | 23   | 29   | 33   | 30   | 35   | 27(22)  | 13(2)  | 31(9)   | 43   | 39(21)   |
| Orthopaedic/Arthritis     | ---  | ---  | ---  | ---  | ---  | ---  | ---  | ---  | 53   | 43   | 49   | 51(22)  | 42(1)  | 46(7)   | 42   | 140(66)  |
| Heart/Lung Blood          | ---  | ---  | ---  | ---  | ---  | ---  | ---  | ---  | 24   | 19   | 23   | 42(21)  | 15(1)  | 42(16)  | 45   | 78(32)   |
| Other                     | ---  | ---  | ---  | ---  | ---  | ---  | ---  | ---  | ---  | ---  | ---  | ---     | ---    | 23      | ---  | 104(51)  |

1970 and 1973-1984 meetings sponsored in part by the Nat. Inst. of Dental Research. The 1980 meeting was sponsored in part by NIAMD. The 1984 Second World Congress on Biomaterials was sponsored in part by the Nat. Inst. of Dental Research, Food & Drug Admin, Natl. Center for Devices & Radiological Health, Office of Naval Res., U.S. Army Inst. of Dental Research, and National Bureau of Standards.

1975-1984 meetings held in conjunction with the Annual Meeting of the Society for Biomaterials.

Note: The 1980 Symposium was held in conjunction with the First World Biomaterials Congress, Baden, Austria.

Numbers in parentheses relate to the Poster Sessions, first held in Baden.

TABLE 2

PROGRAM STATISTICS

SECOND WORLD CONGRESS ON BIOMATERIALS

TOTAL NUMBER OF PAPERS: 361  
ORAL: 191  
POSTER: 170  
TOTAL NUMBER OF AUTHORS: 1245  
TOTAL NUMBER OF COUNTRIES: 18

GEOGRAPHIC DISTRIBUTION OF PAPERS:

| <u>Country</u>              | <u>Number</u> | <u>Percent</u> |
|-----------------------------|---------------|----------------|
| U.S.A.                      | 236           | 65%            |
| Japan                       | 26            | 7              |
| France                      | 23            | 6              |
| Canada                      | 15            | 4              |
| Federal Republic of Germany | 11            | 3              |
| Italy                       | 11            | 3              |
| Netherlands                 | 11            | 3              |
| England                     | 9             | 3              |
| Sweden                      | 4             | -              |
| Czechoslovakia              | 2             | -              |
| Egypt                       | 2             | -              |
| India                       | 2             | -              |
| Israel                      | 2             | -              |
| Switzerland                 | 2             | -              |
| U.S.S.R.                    | 2             | -              |
| Finland                     | 1             | -              |
| Norway                      | 1             | -              |
| Turkey                      | 1             | -              |

Additional attendees from: Australia, Belgium, China, Iran, Ireland, Scotland, South Africa

TABLE 3

SECOND WORLD CONGRESS ON BIOMATERIALS

TOPICS OF PAPERS

General - 104

- 15 Sustained Release
- 20 Ceramics
- 18 Wound Healing
- 14 Cellular Interactions
- 3 Bacterial Interactions
- 6 Bioactive Ceramics
- 28 General Polymer

Cardiovascular - 78

- 17 Polyurethanes
- 14 Protein Adsorption
- 25 Blood/Material Interactions - in Vitro
- 16 Blood/Material Interactions - in Vivo
- 6 Heart Valves and Calcification

Dental - 39

- 16 Dental Implants
- 10 Dental Materials
- 5 Adhesion in Dentistry
- 8 General Dental

Orthopedic - 140

- 7 Wear and Wear Particulates
- 11 Bone-Implant Interface
- 25 Porous Orthopedic Materials
- 8 Bone Replacement Materials
- 13 Bone Cement
- 7 Bone-Electrical Properties
- 19 Corrosion
- 7 Fracture Fixation
- 11 Tendon
- 4 Osteogenesis
- 17 General Orthopedic
- 11 Total Hip

TABLE 4  
SECOND WORLD CONGRESS ON BIOMATERIALS  
PROGRAM COMMITTEE  
DISTRIBUTION OF PAPERS AND SESSIONS

|                | PAPERS        |                |
|----------------|---------------|----------------|
|                | <u>NUMBER</u> | <u>PERCENT</u> |
| General        | 104           | 29%            |
| Cardiovascular | 78            | 22%            |
| Dental         | 39            | 11%            |
| Orthopedic     | 140           | 38%            |
| TOTAL          | 361           |                |

|                | SESSIONS    |                |               |                |
|----------------|-------------|----------------|---------------|----------------|
|                | <u>ORAL</u> | <u>PERCENT</u> | <u>POSTER</u> | <u>PERCENT</u> |
| General        | 16          | 31%            | 9             | 33%            |
| Cardiovascular | 11          | 22%            | 5             | 19%            |
| Dental         | 6           | 12%            | 3             | 11%            |
| Orthopedic     | 18          | 35%            | 10            | 37%            |
| TOTAL          | 51          |                | 27            |                |

|                 |     |
|-----------------|-----|
| ORAL SESSIONS   | 66% |
| POSTER SESSIONS | 34% |

TABLE 5

KEYNOTE ADDRESSES

SECOND WORLD CONGRESS ON BIOMATERIALS

Establishment of an Interdisciplinary Research System for Biomaterials and Artificial Organs. T. Yamamuro, Research Center for Medical Polymers and Biomaterials, Department of Orthopedic Surgery, Kyoto University, Kyoto, Japan.

Highly Swollen Hydrophilic Gels. O. Wichterle, Czechoslovak Academy of Sciences, Prague, Czechoslovakia.

Dental Implants: Biological Aspects and Perspectives. T. Albrektsson, Laboratory of Experimental Biology, Department of Anatomy, University of Gothenburg and the Institute for Applied Biotechnology, Gothenburg, Sweden.

Porous Implants: Interfacial Considerations. R. M. Pilliar, Faculty of Dentistry, University of Toronto, Toronto, Ontario, Canada.

Porosity and the Blood/Materials Interactions. R. A. White, Harbor/UCLA Medical Center, Torrance, California.

The Clinicians Overview on Dental Implants. A. N. Cranin, Brookdale Implant Dental Group, The Brookdale Hospital Medical Center, Brooklyn, New York.

Heparin-Like Biomaterials. M. Jozefowicz and J. Jozefonvicz, Laboratoire de Recherches sur les Macromolécules, Université Paris-Nord Avenue J. B. Clemont, 93430 Villetaneuse, France.

Polymer Surface Composition and Blood/Materials Interaction. A. S. Hoffman, University of Washington, Seattle, Washington.

New Thoughts on Arterial Substitutes: The Biological Period. A. D. Callow, New England Medical Center, Boston, Massachusetts.

TABLE 6

SECOND WORLD CONGRESS ON BIOMATERIALS

TECHNOLOGY TRANSFER

PANEL PRESENTATION AND DISCUSSION

Chairperson: S. Barenberg

Overview: Industrial Perspective

A. S. Michaels, President, A. S. Michaels, Inc., New York, New York.

How Do You Know You Have a Marketable Product?

B. Weinberg, Channing Weinberg, Inc., New York, New York.

Bringing the Discovery Through the Market Place

P. N. Sawyer, Professor of Surgery, Department of Surgery, State University of New York, Downstate Medical Center, Brooklyn, New York.

The Role of the F.D.A.

M. Haffner, Associate Bureau Director for Health Affairs, Food and Drug Administration, Washington, D.C.

Meeting Performance Expectations

E. Muller, Director: Division of Medical Engineering, Office of Science and Technology, National Center for Devices and Radiological Health, Food and Drug Administration, Washington, D.C.

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